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EXAMINER	
SETH, MANAV	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/774,943	DEWAELE, PIET	
	Examiner	Art Unit	
	MANAV SETH	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

4a) Of the above claim(s) *12,13,26,27,38 and 39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,14-25,28-37 and 40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02/09/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Election/Restrictions

1. Applicant's election with traverse of group I including claims 1-11, 14-25, 28-37 and 40 in the reply filed on 03/24/2009 is acknowledged. The traversal is on the ground(s) that "While the office action alleges that there would be a serious burden on the Examiner if restriction was not required, Applicant's note that all claims have been grouped into single class (Class 382). Thus, although the inventions of Groups I and II may be patentably distinct, Applicants submit that the Examiner would not be unduly burdened in the search for prior art relevant to each group of claims". This is not found persuasive because class 382 is a huge class with more than 200 distinct subclasses and examiner has clearly pointed out the subclasses to which the groups belong in the action mailed before. Examiner further asserts that the prior art found in one subclass applied to one group cannot necessarily be applied to another group of claims in another subclass. The restriction requirement is still deemed proper and is therefore made FINAL. Applicant has elected group I claims for examination and thus group I claims have been examined below.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copies have been filed in parent Applications No. (EP) 03100375.9, filed on February 19, 2003.

Specification

3. The disclosure is objected to because of the following informalities:

- The definition of the moment m_{pq} throughout the disclosure is ambiguous at best. Defining the moment of an image $f(x,y)$ as $m_{pq} = \sum_x \sum_y x^p y^q f(x,y)\, dx\, dy$ (page 10 and elsewhere) implies that x and y are both summation indices *and* integration variables. They can be one or the other, but not both. From page 10, line 16, $f(x,y)$ is described as a "digital image." We therefore assume that $f(x,y)$ is a digital image over discrete indices x and y. Then the moments m_{pq} should be defined as follows: $m_{pq} = \sum_x \sum_y x^p y^q f(x,y)$. Likewise the term "$dx\ dy$" should be dropped from the remaining moment definitions.
- In page 11, line 4, mention is made of the "derivatives" of $f(x,y)$. However, as a discrete function $f(x,y)$ cannot be differentiated. It is sufficient to refer to the edge gradient instead.
- In page 10, line 20, "integration" should be replaced with "summation" since $f(x,y)$ is a discrete signal (a digital image).
- In page 13, line 16, the definition of the inverse moment is inconsistent. The left hand side should read m_{kl}, not m_k^{-1}. Otherwise the equation of line 16 is inconsistent with main diagonal moment definition of page 13, line 10.

Appropriate correction is required.

Claim Objections

4. The following is a quotation of 37 CFR 1.75(a):

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

5. Claim 1 is objected to under 37 CFR 1.75(a), as failing to particularly point out and distinctly claim the subject matter which applicant regards as his invention or discovery. Placing the terms "maximum, minimum" in parentheses in a claim raises the question as to whether the terms in question are a claimed requirement. For the parenthetical information to be a claimed requirement the parentheses should be removed and the contents recited directly in the claim.

6. Claims 2 to 7 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Regarding Claim 2: Claim 1 makes it clear that moments of a 2-dimensional image are calculated, thus it is clear that the moments will be calculated for at least one of coordinates x and y.

Regarding Claim 3: By definition, the moments are evaluated on cartesian coordinate system (or alternately on polar coordinate system) along x-axis, y-axis, or both.

Regarding Claim 4: Claim 1 refers to a 2-dimensional signal (digital image), thus its moments can be both 1 and 2 dimensional. As such, claim 4 fails to further limit claim 1.

Regarding Claims 5, 6 and 7: Claim 1 already states that moments are taken relative to different reference entities (different axes and points). Thus, claims 5, 6, and 7 fail to further limit claim 1.

7. Claims 8 and 9 are objected to because of the following informalities:

- Claim 8 describes a *digital* signal as a function with at least one derivative. Digital signals are by definition discrete, and as such not continuous and cannot be differentiated, and thus have no derivatives.
- Regarding Claim 9: As discussed above, the digital signal has no derivative. However, one can define the difference between a digital image and its shift.

Appropriate correction is required.

Claim Rejections - 35 USC § 101

8. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

The USPTO "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (Official Gazette notice of 22 November 2005), Annex IV, reads as follows:

> Descriptive material can be characterized as either "functional descriptive material" or "nonfunctional descriptive material." In this context, "functional descriptive material" consists of data structures and computer programs which impart functionality when employed as a computer component. (The definition of "data structure" is "a physical or logical relationship among data elements, designed to support specific data manipulation functions." The New IEEE Standard Dictionary of Electrical and Electronics Terms 308 (5th ed. 1993).) "Nonfunctional descriptive material" includes but is not limited to music, literary works and a compilation or mere arrangement of data.
>
> When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized. Compare In re Lowry, 32 F.3d 1579, 1583-84, 32 USPQ2d 1031, 1035 (Fed. Cir. 1994) (claim to data structure stored on a computer readable medium that increases computer efficiency held statutory) and Warmerdam, 33 F.3d at 1360-61, 31 USPQ2d at 1759 (claim to computer having a specific data structure stored in memory held statutory product-by-process claim) with Warmerdam, 33 F.3d at 1361, 31 USPQ2d at 1760 (claim to a data structure per se held nonstatutory).
>
> In contrast, a claimed computer-readable medium encoded with a computer program is a computer element which defines structural and functional interrelationships between the computer program and the rest of the computer which permit the computer program's functionality to be realized, and is thus statutory. See Lowry, 32 F.3d at 1583-84, 32 USPQ2d at 1035.

9. Claims 14 and 16-25 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter as follows: The claims define computer programs

embodying functional descriptive material. However, the claim does not define a computer-readable medium or memory and is thus non-statutory for that reason (i.e., "When functional descriptive material is recorded on some computer-readable medium it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized" – Guidelines Annex IV). That is, the scope of the presently claimed computer programs can range from paper on which the program is written, to a program simply contemplated and memorized by a person. The examiner suggests amending the claim to embody the program on "computer-readable medium" or equivalent; assuming the specification does NOT define the computer readable medium as a "signal", "carrier wave", or "transmission medium" which are deemed non-statutory (refer to "note" below). Any amendment to the claim should be commensurate with its corresponding disclosure.

Note:

"A transitory, propagating signal … is not a "process, machine, manufacture, or composition of matter." Those four categories define the explicit scope and reach of subject matter patentable under 35 U.S.C. § 101; thus, such a signal cannot be patentable subject matter." (In re Nuijten, 84 USPQ2d 1495 (Fed. Cir. 2007). Should the full scope of the claim as properly read in light of the disclosure encompass non-statutory subject matter such as a "signal", the claim as a whole would be non-statutory. Should the applicant's specification define or exemplify the computer readable medium or memory (or whatever language applicant chooses to recite a computer readable medium equivalent) as statutory tangible products such as a hard drive, ROM, RAM, etc, **as well as** a non-statutory entity such as a "signal", "carrier wave", or "transmission medium", the examiner suggests

amending the claim to ***include*** the disclosed tangible computer readable storage media, while at the same time ***excluding*** the intangible transitory media such as signals, carrier waves, etc.

Merely reciting functional descriptive material as residing on a tangible medium is not sufficient. If the scope of the claimed medium covers media other than "computer readable" media (e.g., "a tangible media", a "machine-readable media", etc.), the claim remains non-statutory. The full scope of the claimed media (regardless of what words applicant chooses) should not fall outside that of a computer readable medium.

10. Claims 1-11 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. Supreme Court precedent (*Diamond v. Diehr*, 450 U.S. 175, 184 (1981); *Parker v. Flook*, 437 U.S. 584, 588 n.9 (1978); *Gottschalk v. Benson*, 409 U.S. 63, 70 (1972); *Cochrane v. Deener*, 94 U.S. 780, 787-88 (1876)) and recent Federal Circuit decisions (*In re Bilski*, 88 USPQ2d 1385 (Fed. Cir. 2008)) indicate that a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing. While the instant claim(s) recite a series of steps or acts to be performed, the claim(s) neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process. For example, the method for detecting orientation including steps of calculating and obtaining is of sufficient breadth that it would be reasonably interpreted as a series of steps completely performed mentally, verbally or without a machine.. Examiner suggests amending the claims by inserting a statutory category in the body of the claims so that the method steps are positively tied to a statutory category.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

12. Claims 8-9, 22-23 and 34-35 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Digital images cannot be differentiated, as they are discrete, not continuous (note: continuity alone does not guarantee differentiability).

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claims 1-6, 14-20, 28-32 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael, U.S. Patent No. 5,872,870 ("Machine vision methods for identifying extrema of objects in rotated reference frames") further in view of Y. Kawata *et al.* ("Curvature based characterization of shape and internal intensity structure for classification of pulmonary nodules

using thin-section CT images", SPIE Conference on Image Processing, Vol. 3661, pages 541-552, San Diego, February 1999).

Regarding claim 1, Michael addresses the issue of determining the orientation of digital images (or elements therein) ("The digital image data is transmitted from capturing device 10 via a communications path 11 to an image analysis system 12", column 3, line 23) using moments. Michael further teaches estimating image rotation using moments: "Put another way, axes 40x, 40y may be rotated at any angle with respect to axes 32x, 32y. In the illustration, that rotated reference frame is aligned with the principal moments of the object 22 (column 4, line 13)." Also consult figure 2 in Michael. Claim 1 states the following:

" A method of detecting the orientation of a radiographic image represented by a digital signal representation characterized in that mathematical moments of said digital signal representation relative to different reference entities are calculated ("In the illustration, that rotated reference frame is aligned with the principal moments of the object 22," column 4, line 15, also see figure 2) and that a decision on the orientation of said radiographic image is obtained on the basis of an extreme value (maximum, minimum) of the calculated moment(s) ("The method of the invention permits identification of object extrema with respect to reference frames (or coordinate axis) that are rotated with respect to that of the acquisition equipment," column 4, line 3.)."

Michael does not explicitly teach determining orientation of radiographic images. Kawata *et al.* address the issue of shape identification in radiographic images using 3D moments ("We use 3-D moment features to quantify the spread characteristics of the spectral distribution," page 544, Section 4.2). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply Michael's technique of identifying image orientation using moments to Kawata *et al.*'s digital radiography. One of ordinary skill in the art at the time of invention was made

would have been motivated to apply Michael's technique of identifying image orientation using moments to Kawata *et al.*'s digital radiography for the purpose of displaying properly oriented radiographic images.

Regarding claims 2 to 6; claims rejected under 35 U.S.C. 103(a) as being unpatentable over Michael and further in view of Kawata *et al.* as applied to claim 1 above. Regarding claims 2 to 6, Michael states the following: "The method is characterized by the steps of taking a first projection of the object with respect to an axis of a coordinate system that is rotated with respect to the reference frame of the acquisition equipment (column 2, line 10)." The Michael method clearly considers rotations at arbitrary angles. Claim 2 is a special case of 0 and 90 degrees rotations. As for claim 3, it is clear that the moments can be found relative to a cartesian coordinate system with axes parallel to image boundaries. Regarding claim 4 Michael considers 2 dimensional moments since images are 2 dimensional signals. Moreover, computing moments at arbitrary angles necessitates finding moments in both x and y directions. As for claims 5 and 6, both claims consider image projection along an axis that is parallel to the x-axis or the y-axis. Once again those are special cases of the moments evaluated in Michael.

Claims 14-20, 28-32 and 40 have been similarly analyzed as per claims 1-6 (Further see col. 3, lines 25-50 for computer readable medium and computer program).

15. Claim 7, 21 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael, U.S. Patent No. 5,872,870 ("Machine vision methods for identifying extrema of objects in rotated reference frames") further in view of Y. Kawata *et al.* ("Curvature based characterization of shape and internal intensity structure for classification of pulmonary nodules using thin-section CT

images", SPIE Conference on Image Processing, Vol. 3661, pages 541-552, San Diego, February 1999), and further in view of R. Desai and H.D. Cheng ("Pattern recognition by local radial moments," Pattern Recognition, Computer Vision & Image Processing, Proceedings of the 12th IAPR International Conference on , vol. 2, no. pp.168-172, 9-13 Oct 1994).

Claim 7 states the following: "*A method according to claim 1 wherein a moment is generated with respect to at least one predefined point.*" As discussed before, the combination of Michael and Kawata teaches finding the orientation of an object in an image relative to an arbitrary axis using moments. The combination of Michael and Kawata does not explicitly teach finding the moment of an image object relative to a predefined point. Desai *et al.* addresses the issue of finding the moment of an image object relative to a predefined point using radial moments (Desai, page 168, equations 1 & 2). It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Desai *et al.* moment of an image relative to a predefined point to the combination of Michael and Kawata method of determining image region orientation. One of ordinary skill in the art would have been motivated at the time of invention was made to apply Desai *et al.* moment of an image relative to a predefined point to the combination of Michael and Kawata method of determining image region orientation to achieve enhanced estimates of image object orientation.

Claims 21 and 33 have been similarly analyzed as per claim 7.

16. Claim 10, 24 and 36 rejected under 35 U.S.C. 103(a) as being unpatentable over Michael, U.S. Patent No. 5,872,870 ("Machine vision methods for identifying extrema of objects in rotated reference frames") further in view of Y. Kawata *et al.* ("Curvature based characterization of shape and internal intensity structure for classification of pulmonary nodules using thin-section CT images", SPIE Conference on Image Processing, Vol. 3661, pages 541-552, San Diego, February

1999), and further in view of P. Dewaele, M. Ibison, and P. Vuylsteke ("A Trainable rule-based network for irradiation field recognition in AGFA's ADC system," Proc. of SPIE – Vol. 2708, Medical Imaging: Physics of Medical Imaging, R. Van Metter, J. Beutel, Editors, April 1996, pp. 72-84).

Claim 10 states the following: "A method according to claim 1 wherein collimation area are excluded from said digital signal representation." As discussed before, the combination of Michael and Kawata teaches finding the orientation of an object in an image relative to an arbitrary axis using moments. The combination of Michael and Kawata does not explicitly teach identifying and excluding the collimation area from the rest of the image. Dewaele et al. address the issue of identifying and excluding collimation area from a digital image ("To achieve this function automatically, best results are obtained if, for each sub-image, the shadow cast by the collimation material is excluded from consideration," page 72). It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Dewaele et al. technique of identifying and excluding collimation to the combination of Michael and Kawata method of determining image region orientation. One of ordinary skill in the art at the time of invention would have been motivated to apply Dewaele et al. technique of identifying and excluding collimation to the combination of Michael and Kawata method of determining image region orientation so as to obtain enhanced diagnostic area of the image.

Claims 24 and 36 have been similarly analyzed as per claim 10.

17. Claims 11, 25 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Michael, U.S. Patent No. 5,872,870 ("Machine vision methods for identifying extrema of objects in rotated

reference frames") further in view of Y. Kawata *et al.* ("Curvature based characterization of shape and internal intensity structure for classification of pulmonary nodules using thin-section CT images", SPIE Conference on Image Processing, Vol. 3661, pages 541-552, San Diego, February 1999), and further in view of P. Dewaele EP1256907 A1 ("Retrospective correction of inhomogeneities in radiographs").

Claim 11 states the following: "A method according to claim 1 wherein direct exposure area are excluded from said digital signal representation." As discussed before, the combination of Michael and Kawata teaches finding the orientation of an object in an image relative to an arbitrary axis using moments. The combination of Michael and Kawata does not explicitly teach identifying and excluding the direct exposure area from the rest of the image. Dewaele addresses the issue of estimating and extracting the direct exposure area ("In one embodiment (1) a mathematical model representing the phenomenon that induces the inhomogeneities is generated. Next (2) the digital image representation is subjected to image segmentation in order to extract data representing an estimation of the direct exposure area," paragraph [0017]). It would have been obvious at the time the invention was made to one of ordinary skill in the art to apply Dewaele technique of identifying and excluding direct exposure area to the combination of Michael and Kawata method of determining image region orientation. One of ordinary skill in the art at the time of invention was made would have been motivated to apply Dewaele technique of identifying and excluding direct exposure area to the combination of Michael and Kawata method of determining image region orientation so as to obtain enhanced diagnostic area of the image.

Claims 25 and 37 have been similarly analyzed as per claim 11.

Examiner note: Examiner has cited particular columns and line numbers in the references as applied to the claims above for the convenience of the applicant. Although the specified citations are representative of the teachings for the art and are applied to the specific limitations within the individual claim, other passages and figures may be applied as well. It is respectfully requested from the applicant in preparing responses, to fully consider the references entirely as potential teachings all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali, can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Manav Seth/
Examiner, Art Unit 2624
May 10, 2009